

Executive Summary

The Monitoring and Reporting Program (MRP) requirements for the City of San Diego (City) Point Loma Wastewater Treatment Plant (PLWTP) are outlined in Order No. R9-2002-0025, NPDES Permit No. CA0107409, and as subsequently modified by Addendum No. 1 in 2003 and Addendum No. 2 in 2008 (see Chapter 1). The primary objectives of the Point Loma ocean monitoring program are to a) fulfill NPDES permit requirements for receiving waters monitoring, b) measure compliance with water-contact standards specified in the 2001 California Ocean Plan (COP), and c) assess the impact of wastewater discharged through the Point Loma Ocean Outfall (PLOO) on the marine environment off San Diego, including any effects on ocean water quality, sediment conditions, and marine organisms. The study area encompasses approximately 184 km² of coastal waters centered around the PLOO discharge site, which is located approximately 7.2 km offshore of the PLWTP at a depth of nearly 100 m. Monitoring at stations along the shoreline extends from Mission Beach southward to the tip of Point Loma, while offshore monitoring occurs in an adjacent area overlying the continental shelf at sites ranging from 9 to 116 m in depth.

The City conducts other types of studies in addition to its regular monitoring for Point Loma that are useful for evaluating patterns and trends over time or that span broader geographic regions, thus providing additional information to help distinguish reference areas from sites that may be affected by anthropogenic influences. For example, prior to the initiation of wastewater discharge at the present deepwater location in late 1993, the City conducted a 2½-year baseline study designed to characterize background environmental conditions in the PLOO region in order to provide information against which post-discharge data could be compared. Additionally, the City typically conducts an annual summer survey of benthic conditions for the San Diego region at randomly selected sites that range from Del Mar to the USA/Mexico border as part of

the South Bay Ocean Outfall monitoring program. The City also collaborates with other organizations on larger-scale, regional monitoring projects that span the entire Southern California Bight (SCB). Such previous bight-wide surveys include the Southern California Bight Pilot Project in 1994, and the subsequent Bight'98 and Bight'03 projects in 1998 and 2003, respectively. Currently, the City is participating in the Bight'08 regional monitoring program, which began during the summer of 2008. However, in order to participate in Bight'08, some regular monitoring requirements for both the Point Loma and South Bay regions were relaxed in 2008 (see Chapter 1).

The receiving waters monitoring effort for the Point Loma region is divided into several major components, with each comprising a separate chapter in this report, including: Oceanographic Conditions, Microbiology, Sediment Characteristics, Macrobenthic Communities, Demersal Fishes and Megabenthic Invertebrates, and Bioaccumulation of Contaminants in Fish Tissues. Chapter 1 presents a general introduction and overview of the City's ocean monitoring program, as well as background information on wastewater treatment processes at the PLWTP, including the initiation of chlorination in late 2008. In Chapter 2, data regarding various physical and chemical oceanographic parameters are evaluated to characterize water mass transport potential in the region. Chapter 3 presents the results of water quality monitoring conducted along the shore and in offshore waters, which includes the measurement of fecal indicator bacteria to assess potential effects of both natural and anthropogenic inputs, and to determine compliance with water-contact standards specified in the 2001 COP. The results of benthic sampling and analyses of soft-bottom sediments and their associated macrofaunal communities are presented in Chapters 4 and 5, respectively. Chapter 6 presents the results of trawling activities to assess the status of bottom dwelling (demersal) fish and megabenthic invertebrate communities. Bioaccumulation studies to determine whether contaminants are present in

the tissues of local fishes supplement the monitoring of fish populations and are presented in Chapter 7. In addition to the above activities, the City supports other projects relevant to assessing ocean quality in the region (see Chapter 1). One such project is a remote sensing study of the San Diego and Tijuana coastal regions. These results are incorporated herein into interpretations of oceanographic and microbiological data (see Chapters 2 and 3).

The present report focuses on the results of all ocean monitoring activities conducted in the Point Loma region during calendar year 2008. In general, these data indicate that the Point Loma outfall has had only a limited and localized effect on the marine environment off San Diego after 15 years of wastewater discharge at the present deepwater location. An overview and summary of the main findings for each of the major components of the monitoring program over the past year are included below.

OCEANOGRAPHIC CONDITIONS

Overall, there continues to be no evidence of change in any physical or chemical water quality parameter such as dissolved oxygen concentrations or pH levels that can be attributed to the discharge of wastewater off Point Loma. Instead, observed variations in ocean conditions in 2008 were notably consistent with what would be expected due to typical seasonal cycles, as well as with changes in larger patterns reported for the California Current System. Together, this suggests that other factors such as the upwelling of deep, cool, and nutrient-rich waters during the spring months, the occurrence of associated phytoplankton blooms, and the effects of large-scale oceanographic events such as El Niño-La Niña oscillations may best explain most of the temporal and spatial variability observed in these types of water quality parameters for the Point Loma region.

MICROBIOLOGY

There was no evidence that wastewater discharged to the ocean via the PLOO reached surface waters

or contaminated shoreline or near-shore recreational waters in 2008. For example, the wastewater plume was not detected in any aerial and satellite imagery taken during the year. Although elevated counts for fecal indicator bacteria (FIB) such as total coliforms, fecal coliforms and/or enterococcus were occasionally detected along the shore and at a few nearshore stations, concentrations of these bacteria tended to be relatively low overall. In general, elevated FIB densities were limited to instances when contamination was most likely associated with rainfall (i.e., storms), heavy recreational use, or decaying plant material (e.g., kelp and surfgrass along the shore). In addition, all seawater samples collected at the eight kelp bed stations during the year, and from all but one of the eight shore stations (i.e., D8), were 100% compliant with the four COP standards; the few exceedances that did occur at station D8 corresponded to rain events or other sources of contamination unrelated to the PLOO discharge. The elevated FIB counts that could be attributable to wastewater discharge were limited to offshore waters at depths of 60 m or below. This finding supports previous analyses of water quality data for the region, which have indicated that the PLOO waste field has typically remained well offshore and submerged in deep waters ever since completion of the outfall extension in late 1993.

SEDIMENT CHARACTERISTICS

Ocean sediments at stations surrounding the PLOO in 2008 were comprised primarily of fine sands and coarse silt, which is similar to patterns seen in previous years. Overall, differences in the particle size composition of sediments off Point Loma are likely affected by both anthropogenic and natural influences, including outfall construction materials, offshore disposal of dredged materials, multiple geological origins of different sediment types, and recent deposits of detrital materials. There was no evident relationship between sediment composition and proximity to the outfall discharge site.

Concentrations of various contaminants, including most organic loading indicators (e.g., biochemical

oxygen demand or BOD, total nitrogen, total volatile solids), trace metals, pesticides (e.g., DDT), PCBs, and PAHs in sediments off Point Loma remained within the typical range of variability for San Diego and other areas of the southern California continental shelf. The only contaminant that exceeded the Effects Range Low environmental threshold value for southern California was silver, which was present in relatively high concentrations throughout the region. Overall, there were few clear spatial patterns in sediment contaminant concentrations relative to the PLOO discharge site in 2008, with the exception of slightly elevated sulfide and BOD levels near the outfall. Instead, the highest concentrations of several contaminants occurred at sites relatively distant from the outfall. These included the highest copper, mercury, total PCB, and total PAH values, all of which occurred in sediments near the LA-5 dredged materials disposal site. This pattern is consistent with other studies that have suggested that sediment contamination at these and other southern stations off San Diego is most likely due to misplaced deposits (i.e., short dumps) of dredged materials originally destined for LA-5.

MACROBENTHIC COMMUNITIES

Benthic communities surrounding the PLOO in 2008 were dominated by ophiuroid-polychaete based assemblages, with few major changes having occurred since monitoring began in 1991. Polychaetes and ophiuroids were the most abundant and diverse taxa in the region. Although many of the assemblages present during the year were dominated by similar species, the relative abundance of these species varied among sites. The brittle star *Amphiodia urtica* was the most abundant and widespread species in the region, while the capitellid polychaete *Mediomastus* sp was the second most widespread benthic invertebrate. Overall, these assemblages were typical of those occurring in other mid-depth areas of the SCB with similar, relatively fine sediment habitats.

Benthic conditions off Point Loma did reflect some changes in 2008 that may be expected near

large ocean outfalls, although these effects were restricted to a relatively small, localized region within about 300 m of the outfall diffuser legs. For example, some descriptors of benthic community structure (e.g., infaunal abundance, species diversity) or populations of indicator species (e.g., *A. urtica*) have shown small changes over time between reference areas and sites located nearest the outfall. However, results for the benthic response index (BRI) were characteristic of undisturbed sediments. In addition, changes in macrofaunal community structure that did occur during the year were similar in magnitude to those that have occurred previously and elsewhere off southern California. Overall, macrofaunal assemblages in the region remain similar those observed prior to wastewater discharge and to natural indigenous communities characteristic of similar habitats on the southern California continental shelf. There was no evidence that wastewater discharge has caused degradation of the marine benthos in the PLOO monitoring region.

DEMERSAL FISHES AND MEGABENTHIC INVERTEBRATES

Pacific sanddabs continued to dominate fish assemblages surrounding the PLOO during 2008 as they have for many years. This species occurred at all stations and accounted for 45% of the total fish catch. Other characteristic, but less abundant species included halfbanded rockfish, longspine combfish, English sole, Dover sole, shortspine combfish, yellowchin sculpin, plainfin midshipman, pink seaperch, roughback sculpin, and hornyhead turbot. Although the overall composition and structure of the fish assemblages present off Point Loma varied among stations, most differences were due to fluctuations in Pacific sanddab populations.

Assemblages of relatively large (megabenthic) trawl-caught invertebrates in the region were similarly dominated by a single species, the white sea urchin *Lytechinus pictus*. Variations in the overall structure of this invertebrate community off Point Loma generally reflect differences in the abundance

of this particular urchin, as well as several other co-dominant species. These other common species include the sea pen *Acanthoptilum* sp, the sea star *Luidia foliolata*, the sea cucumber *Parastichopus californicus*, the brittle star *Ophiura luetkenii*, the octopus *Octopus rubescens*, and the sea urchin *Strongylocentrotus fragilis*.

Overall, results of the 2008 trawl surveys provide no evidence that wastewater discharged through the PLOO has affected either demersal fish or megabenthic invertebrate communities in the region. Although highly variable, patterns in the abundance and distribution of these trawl-caught species were similar at stations located near the outfall and farther away. These results are supported by the findings of another recent assessment of these communities off San Diego. Significant changes in these fish and invertebrate communities appear most likely to be due to natural factors such as changes in ocean temperatures associated with large-scale oceanographic events (e.g., El Niño or La Niña) or to the mobile nature of many species. Finally, the absence of any indicators of disease or other physical abnormalities in local fishes suggests that their populations remain healthy in the region.

CONTAMINANTS IN FISH TISSUES

There was no clear evidence to suggest that tissue contaminant loads in fish captured at the PLOO monitoring sites were affected by the discharge of wastewater in 2008. Several trace metals, three pesticides (i.e., DDT, hexachlorobenzene,

chlordane), and various PCB congeners were detected frequently in liver tissues from flatfish and muscle tissues from rockfish sampled in the region during the year. The various contaminants were distributed widely among the stations and showed no patterns that could be attributed to wastewater discharge. Further, all contaminant values were within the range of those reported previously for southern California fishes. Finally, while some muscle tissue samples from sport fish collected off Point Loma had arsenic and selenium concentrations above the median international standard for shellfish, and some samples had mercury levels that exceeded OEHHA fish contaminant goals, concentrations of mercury and DDT were still below U.S. FDA human consumption limits.

The occurrence and accumulation of both trace metals and chlorinated hydrocarbons in the tissues of Point Loma fishes may be due to many factors, including the widespread distribution of many contaminants in coastal sediments off southern California. Other factors that affect the bioaccumulation and distribution of contaminants in local fishes include the different physiologies and life history traits of various species. Exposure to contaminants can vary greatly between species and even among individuals of the same species depending on migration habits. For example, fish may be exposed to pollutants in a highly contaminated area and then move into a region that is less contaminated. This is of particular concern for fishes collected in the vicinity of the PLOO, as there are many other point and non-point sources in the region that may contribute to contamination.